PATENT SPECIFICATION

785,097

Date of Application and filing Complete Specification Nov. 3, 1955.

No. 31470/55.

Application made in Italy on Nov. 11, 1954.

Complete Specification Published Oct. 23, 1957.

Index at Acceptance:—Class 144(2), C3(B12: D3).

International Classification:—B62g.

COMPLETE SPECIFICATION

Improvements relating to Pneumatic Vehicle Wheel Tyres for use either on Normal Ground Surfaces or on Ground Surfaces which are Loose or Yielding

We, PIRELLI SOCIETA PER AZIONI, a Limited Liability Company organised under the Laws of Italy, of 94, Viale Abruzzi, Milan, Italy, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to pneumatic vehicle wheel tyres for use either on normal ground surfaces or on ground surfaces which are loose or yielding. The term "ground surfaces" includes both road surfaces and surfaces off the road, e.g. the surfaces of fields and like agricultural areas, and "loose or yielding" means either in the dry condition of the ground surface, as in the case for example of a sandy or soft and crumbly soil surface, or in a wet (e.g. muddy) or snow covered condition.

The object of the invention is to provide an improved construction of tyre which will ensure good running properties in respect of the tyre, including optimum road traction, irrespective of which type of ground surface the tyre is running on, whether it be the normal hard (solid) type, e.g. a normal road surface, or the loose or yielding type as above referred to.

It is known that tyres required for use on loose or yielding ground surfaces, for example rough clay soil or muddy, marshy or sandy soil, should have greater cross-sectional dimensions than those which are typical (for a given diameter of tyre) of tyres for use on road surfaces of normal hardness. The greater cross-sectional dimensions tend to reduce the specific pressure exerted by the tyre upon the ground and correspondingly to limit or avoid the embedding of the tyre thereinto.

Such larger dimension tyres require, however, that the vehicle to be fitted with them shall be specially designed to accommodate the large dimensions of the tyre. Alternatively it is impossible to use the vehicle on certain types of ground surfaces. In addition such larger dimensioned tyres are considerably more costly to produce than a normal tyre.

According to the present invention, there is provided a pneumatic vehicle wheel tyre having a main tread whose peripheral surface is substantially flat in the cross-section of the tyre and whose width is not substantially less than two-thirds of the maximum width of the carcass portion of the tyre, and at each side of said main tread, at a position inset, radially of the tyre, from the lateral boundary of said peripheral surface, a supplementary tread adapted to come into operation only when the tyre is used on a ground surface which is loose or yielding, said supplementary tread being constituted by an annular shoulder extending continuously or discontinuously along the tyre, said shoulder being of such form in the cross-section of the tyre that its radially outwardly directed surface or (in the case of a shoulder extending discontinuously) surfaces conform, in the unloaded condition of the tyre, to the surface of a cone frustum disposed with its base towards the mid-circumferential plane of the tyre, the angle of conicity of the frustum being such that along the portion of the tyre which is squeezed and in consequence compressed against the ground when the tyre is under load, the line in the cross-section of the tyre of said radially outwardly directed surface or surfaces lies substantially parallel to the rotational axis of the tyre, having been brought to this position by the compression of the tyre.

With a tyre embodying this invention the effect when the tyre is used on a loose or yielding ground surface is that the tread portion of the tyre embeds itself in the ground, forming a rut in which the tyre as a whole is guided with consequent maximum road traction, even on very crumbly soil. At the same time the further important effect is achieved that the shoulders on the two sides of the tyre, by coming into contact with the ground surface in

consequence of the embedding of the tread portion of the tyre therein, add their quota of load supporting surface to that of said tread portion, so further ensuring good running properties to the tyre.

The shoulders will generally be suitably buttressed from the side wall portion of the tyre, either by circumferentially spaced radial webs or by gradually merging the line of the profile of the shoulders, in the cross-section of the tyre, into the line of the profile of the side wall portion of the tyre.

The shoulders are preferably moulded in one integral unit with the side wall and main tread portions of the tyre.

The invention will now be further described with reference to the accompanying drawings, which illustrate a generally preferred embodiment by way of example.

In these drawings:—

Figure 1 is a cross-section through the tyre in the non-loading condition thereof, and

Figure 2 is a cross-section through the lower part of the tyre when the latter is in the loaded condition, the said lower part being the part which is squeezed against the ground, with resulting deformation of the tyre, under the load P applied to the tyre along the line of the arrow indicated in the figure.

The tyre shown comprises a tread 1 whose peripheral (ground contacting) surface is nearly flat in the cross-section of the tyre, a carcass 2 and two supplementary treads as hereinbefore referred to formed respectively by a pair of annular shoulders 3. The tyre is shown in mounted position on a wheel rim 4 and is assumed to be inflated.

The shoulders 3 are composed of any suitable rubber compound and form a unitary moulded structure with the main tread 1 and the carcass 2, being located in each case at a position inset, radially of the tyre, by a distance H from the lateral boundary of the peripheral surface of the main tread 1, at which position they are disposed as shown adjacent the radially outermost zones of the side walls of the carcass.

The sides of the main tread 1 make in each case (considering the tyre in the unloaded condition thereof, and therefore considering the portion of the tyre which is not in contact with the ground when the tyre is in use) an obtuse angle α with the radially outwardly directed surface of the adjacent shoulder 3, the angle α being of such magnitude that said radially outwardly directed surface conforms substantially to the surface of a cone frustum having its base directed towards the mid-circumferential plane of the tyre and the line of the surface, in the cross-section of the tyre, being disposed at an angle β to the rotational axis of the tyre.

During the running of the tyre on a normal (hard) ground surface, e.g. a normal road surface, only the main tread of the tyre is in contact therewith. During running of the tyre on a loose or yielding ground surface as above referred to, owing to the embedding of the tyre into said surface, not only is the main tread in engagement with the surface but also the radially outwardly directed surfaces of the shoulders 3, with the result that these shoulders participate in the load supporting function of the tyre, increasing the effective width of the load supporting zone of the tyre surface from L, the width of the main tread, to L^1, the overall width of the main tread plus the two shoulders 3. The effect is illustrated clearly in Figure 2, where the lower part of the tyre, where the latter is squeezed and in consequence compressed against the ground surface under the load P, is represented to the left of the mid-circumferential plane of the tyre as running on a normal ground surface and to the right on a loose or yielding ground surface.

The angle α, which may be any convenient angle between 91° and 140°, should be so chosen that along the aforesaid lower portion of the tyre the radially outwardly directed surfaces of the shoulders 3 are, in the cross-section of the tyre, parallel or nearly so to the rotational axis of the tyre, having been brought to this position in consequence of deformation of the tyre section under the load P, which deformation involves a flexing to a smaller radius of the side wall portions of the tyre to which the shoulders are integrally connected.

Otherwise expressed, the magnitude of the angle α should be such, having regard to the extent to which the section of the tyre deforms along the portion which is squeezed against the ground surface when the tyre is under load, that while in the rest (non-loaded) condition of the tyre the lines of the radially directed surfaces of the shoulders 3 form, in the cross-section of the tyre, the angle β with the rotational axis of the tyre and therefore with a line normal to the mid-circumferential plane of the tyre and passing through the zone of junction of the periphery of the shoulder with the side of the main tread 1, this angle is reduced along the portion of the tyre which in the loaded condition thereof is squeezed against the ground surface to a value equal or nearly equal to zero, with the result that the angle included between the periphery (radially outwardly directed surface) of the shoulder and the side of the main tread assumes a value α^1 equal or nearly equal to $\alpha-\beta$.

The width of the main tread may be of any convenient magnitude not substantially less than two-thirds of the width C of the carcass portion of the tyre and the overall width L^1 of the ground contacting zone of the tyre made up of the width of the main tread 1 and the combined widths of the two supplementary treads formed by the shoulders 3, may be of any desired magnitude up to or, as in the

particular embodiment of the invention illustrated, greater than said overall width C. The increase in the width of the load carrying surface of the tyre from L to L^1 is limited only by practical overall requirements due to the dimension L^1 and, as will be understood, the effect of said increase is to provide for a greater distribution of the load P on a working length of the load supporting area of the tyre (Figure 2) measured along the line of the mid-circumference of the tyre.

The present invention may be applied to tyres of conventional construction, the carcass of the tyre being formed of several superimposed plies each consisting of an assembly of cords laid parallel to one another in the ply and composed of a material of natural, artificial or synthetic origin, the plies being arranged in such a way that the cords are alternately crossed in the various layers. The invention may also be applied to tyres constructed in accordance with the inventions described in the Specifications of United Kingdom Patents No. 700,435, No. 726,810, No. 755,990, and No. 769,325.

As already indicated, the shoulders 3 may be either continuous or discontinuous (interrupted) circumferentially of the tyre and the extent to which the shoulders are inset from the lateral boundary of the peripheral surface of the main tread may be such that when the tyre is running on a normal ground surface only the main tread comes into contact therewith, even when the tread pattern thereof is worn down completely by abrasion.

What we claim is:—

1. A pneumatic vehicle wheel tyre having a main tread whose peripheral surface is substantially flat in the cross-section of the tyre and whose width is not substantially less than two-thirds of the maximum width of the carcass portion of the tyre, and at each side of said main tread, at a position inset, radially of the tyre, from the lateral boundary of said peripheral surface, a supplementary tread adapted to come into operation only when the tyre is used on a ground surface which is loose or yielding, said supplementary tread being constituted by an annular shoulder extending continuously or discontinuously along the tyre, said shoulder being of such form, in the cross-section of the tyre, that its radially outwardly directed surface or (in the case of a shoulder extending discontinuously) surfaces conform, in the unloaded condition of the tyre, to the surface of a cone frustum disposed with its base towards the mid-circumferential plane of the tyre, the angle of conicity of the frustum being such that along the portion of the tyre which is squeezed and in consequence compressed against the ground when the tyre is under load, the line in the cross-section of the tyre of said radially outwardly directed surface or surfaces lies substantially parallel to the rotational axis of the tyre, having been brought to this position by the compression of the tyre.

2. A pneumatic vehicle wheel tyre according to Claim 1, wherein (considering each side of the tyre) the angle formed in the cross-section of the tyre between the side of the main tread and said radially outwardly directed surface or surfaces of the supplementary tread is an obtuse angle.

3. A pneumatic vehicle wheel tyre according to Claim 2, wherein said angle is within the range of from 91° to 140°.

4. A pneumatic vehicle wheel tyre according to any of the preceding Claims, wherein the extent to which the supplementary treads are inset from the lateral boudary of the peripheral surface of the main tread is such that when the tyre is running on a normal ground surface only the main tread comes into contact therewith even when the tread pattern thereof is worn down completely.

5. A pneumatic vehicle wheel tyre for use either on normal ground surfaces or on ground surfaces which are loose or yielding, constructed substantially as hereinbefore described with reference to the accompanying drawings.

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Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press,—1957.
Published at the Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

785,097 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

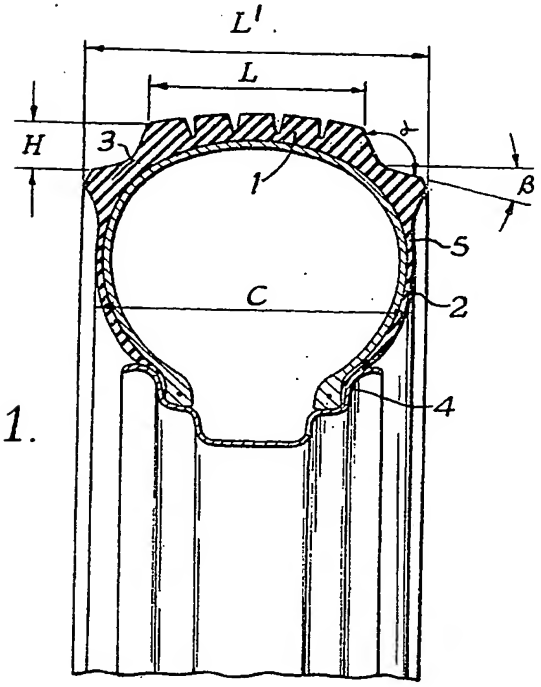

Fig. 1.

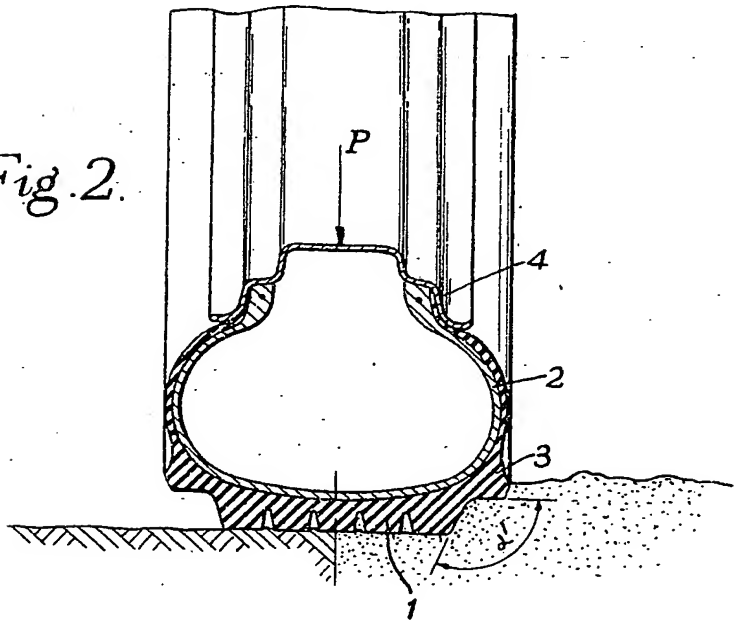

Fig. 2.